

**REMARKS:**

In the office action dated January 17, 2006, the Examiner rejected Claims 1, 2, 4, 5, 7-9 and 11-19 of the present application under 35 U.S.C. § 103(a), citing Rohrbach et al. (US 6,379,564), in view of Drozd et al. (US 6,835,218) and Graiff et al. (US 5,300,218). It is submitted that the amendments and arguments presented herein overcome the Examiner's rejections, and that for at least the reasons presented herein, the present application is now in condition for allowance.

**Amendments to the Claims**

Amendments have been made to Claims 1, 7, and 17-19. Claim 8 has been cancelled. No new matter has been added by these amendments.

Support for the amendments to the claims that a fuel additive is removed by equilibrium forces that exchange the additive for a fuel component is found on page 7 of the specification, at lines 2-4 and 7-10. The precise nature of the exchange is attributed to a known binding/equilibrium constant optimized to reversibly bind a fuel additive to the ion-exchange resin, and upon immersion of the device in fuel, a specific ionic fuel component displaces the additive. Upon exchange, the fuel component is then reversibly bound by ionic forces to the ion-exchange resin, thereby releasing the fuel additive in the fuel.

Support for amendments to the claims providing that the ion-exchange device is immersed in the fuel to provide time-released treatment is found in the present specification on page 9, at lines 5-10.

**Rejections of the Claims Under 35 U.S.C. § 103(a)**

In rejecting the claims under 35 U.S.C. § 103(a), the Examiner relied on Rohrbach et al. (US 6,379,564, hereinafter "Rohrbach"), in view of Drozd et al. (US 6,835,218, hereinafter "Drozd") and Graiff et al. (US 5,300,218, hereinafter "Graiff").

*Rejections in View of Rohrbach (US 6,379,654)*

The Examiner rejected Claims 1 and 17-19 in view of Rohrbach. The Examiner stated that Rohrbach discloses a filter device comprising what "may be a high surface area sorbent" having a releasably attached additive. The Examiner further provided that the device of

Rohrbach caused “chemical interactions” with the fluid being treated, and additionally, permitted slow controlled release of the additive. Finally, the Examiner found that while Rohrbach does not “explicitly” require that the adsorbent be an ion exchange resin, materials were suggested that were functionally similar by having high surface area and surface modified sorbents having “high binding activities.”

In contrast, the presently claimed invention is inherently different from Rohrbach as it releases a fuel additive by *selective ionic displacement*, where the ion-exchange resin not only reversibly releases components but reversibly binds them as well, capitalizing on its strategically selected ionic binding or equilibrium constant. Thus, in contrast to the cited references, the presently claimed invention functions at multiple different levels by providing an ionically bound additive to a fuel while simultaneously receiving an ion from the fuel, and this equilibrium-directed process is both selective and reversible. The principles of ion exchange are neither disclosed nor suggested by Rohrbach, who instead suggests the introduction of a “reagent” that is physically held and irreversibly released by fibers into an oil.

It is crucial to note however, that Rohrbach contemplates the release of an additive through non-specific *physical* processes such as diffusion, adsorption, sorption, entrapment, and miscibility—and does not provide for the selective *chemical* process of ion exchange through which an additive is released only when it is replaced by another selective ion, and at a rate dictated by its binding/equilibrium constant. Furthermore, ion-exchange is inherently a *reversible* process in which a displaced ion may reattach to its original site, ultimately directed toward achieving equilibrium, and one in which the substrate (resin) is permanently charged and reactive. This distinguishes the presently claimed invention from the references, as the controlled release of the additive is effectuated by the long-term interactions between the ions and ion-exchange resin. As provided in the presently amended claims, the presently claimed invention specifies that the device is immersed in the fuel—implicating long-term ionic exchange of ions—rather than short-term, flow and force directed displacement of a reagent. Rohrbach, on the other hand, provides exclusively for the in-line delivery of additives into a filtered fluid. (Col. 3, lines 5-7)

Additionally, the presently claimed invention achieves controlled release of an additive through optimization of the competing binding strengths of the ion-exchange resin and additive, and the ion-exchange resin and fuel component. Alternately stated, the release of additive is

accomplished by strategic ion displacement and ion replacement based on relative binding strengths—but not, as Rohrbach contemplates, through physical holding of a reagent/additive, that is disrupted by “reactions” between an additive and a fluid streaming past. Rohrbach presents an entrapped (“wicked” or “associated”) reagent that is contacted by an oil by passing the oil through the fibers to effectuate a dislocation or reaction between the “reagent” and the “oil” (Col. 3, lines 48-60), or through the “miscibility” of the reagent in the oil (Col. 3, line 49).

No element *replaces* the displaced reagent from the fibers disclosed by Rohrbach, and as the reaction is targeted between the oil and additive, there is no indication of specificity of interaction, or of an equilibrium in which the additive molecules may re-attach to their original site. In the least, the presently claimed invention is distinguishable from Rohrbach by: relying on reversible chemical interactions between a permanently coated resin and the ions exchanged upon it to control the release of the additive; allowing for the long-term reversible binding of the additive through immersion of the ion-exchange resin in fuel; and through the selectivity of its displacement and binding of an alternate ion through a measurable feature—its selected binding/equilibrium constant.

Finally, Rohrbach provides that the reagent “may also contain alone or in combination many other reagents *for removing various contaminants*,” including activated carbon, zeolites (or modified forms thereof), or sorbents. (emphasis added, Col. 7, lines 40-48) Importantly, these substances are presented as means to remove contaminants, and not to specifically provide a beneficial fuel additive through an equilibrium-directed process. As noted above, activated carbon and “sorbents” are adsorbents and function through physical rather than chemical processes—and do not release additives. Zeolites are naturally-occurring substances that have been used as adsorbents for removing contaminants, and primarily heavy metals. However, zeolites are neither disclosed nor suggested by Rohrbach as a mechanism for releasing an additive, or any other agent. Even in view Rohrbach’s reference to zeolites to potentially remove contaminants, it is neither contemplated nor speculated that an immersed ion-exchange device could achieve the targeted specificity, equilibrium, and reversible binding of the presently claimed invention. To summarize, in view of Rohrbach, one would not be led to contemplate an immersed device capable of achieving the benefits of releasing a fuel additive using an ion-exchange resin.

*Further Rejections in View of Drozd (US 6,835,218)*

The Examiner stated that Drozd further suggests an ion exchange resin by referring to adsorbents and thermoplastic resins, thus arguably rendering the presently claimed invention obvious to one skilled in the art in view of Rohrbach's disclosure. However, Drozd presents only adsorbents and other inert materials that achieve "sustained release" by releasing trapped additive. Importantly, Drozd, as does Rohrbach, contemplates in-line delivery along the fuel line rather than long-term immersion of an ion-exchange device. (Drozd: Col. 2, lines 40-41; Col. 3, lines 2-3, and lines 22-24) Further, Drozd does not teach or suggest that the additive or any other components in the fuel could form a reversible ionic bond on a permanently charged substrate. Thus, Drozd does recognize the desirability of slow release of an additive, however, the presently claimed invention's implementation, function, and results are quite distinguishable.

First, the presently claimed invention's use of an ion exchange resin would not be suggested by Drozd, alone or in combination with Rohrbach, because Drozd does not disclose or suggest materials or methods relating to ionic bonding and/or equilibrium. The additive compositions are provided by Drozd as preferably disposed on a particle or pellet (Col. 3, lines 26-30) with the additive composition is coated on the surface. The additive may alternatively be "admixed" with a sustained release component (insoluble matrix) to "impart beneficial properties with the fuel being circulated through the filter unit." (Col. 5, lines 4-6) The sustained release component is presented as an insoluble polymeric material that "*serves as a physical barrier* between the fuel and the additive component to slow down the release, for example, diffusion, of additives into fuel." (emphasis added, Col. 12, lines 30-34) Thus, Drozd would not lead one skilled in the art to contemplate a reversible chemical exchange guided by equilibrium principles, as its admixed or coated substances physically slow down the release of an additive—but neither an additive nor a fuel component are ionically bound to a substrate, much less exchanged, at permanently charged sites.

Second, Drozd does not suggest an ion exchange resin by simply disclosing acid waxes, polymers, and resins that are analogous to ion-exchange resins. (e.g., fuel-insoluble polymeric materials and styrene at Col. 14, lines 7-67; Col. 15, lines 1-14) There is no teaching or suggestion in Drozd to utilize a (permanently) ionically charged matrix or substrate, and particularly one having a measurable and targeted binding/equilibrium constant. Instead, Drozd presents an embodiment in which a rate-improving release enhancer is used that is non-ionic.

(Col. 15, line 52) The rate of additive release by Drozd is controlled by either adjusting the amount of matrix material with which the additive has been admixed, or adjusting the thickness of the coating on the additive composition. (Col. 17, lines 57-67; Col. 8, lines 35-38) Thus, Drozd could not render the presently claimed invention obvious as it does not contemplate reversible ionic exchange, and further, it relies on mixtures or coatings of inert materials that have no interaction with either the additive or the components in the fuel.

Finally, Drozd does not contemplate a long-term equilibrium-directed process utilizing an immersed device, but rather, one that relies on in-line delivery controlled by physical barriers and concentration gradients. Specifically, Drozd states that “[t]he rate of additive release is dependent on the concentration of the additive in the additive composition.” (Col. 22, lines 56-57) In contrast, the presently claimed invention contemplates release over periods exceeding 5 years (see, Present Application, p. 9, lines 9-10), utilizing characteristic and known binding/equilibrium constants to tailor the release of bound material to the desired end use. (see, Present Application, p. 7, lines 2-4) This drastically differs from Drozd, who contemplates maximum release intervals of up to 600 hours based on concentration gradients and dissolution of matrices and/or coatings. In contrast, the presently claimed invention possesses the ability to be operative over a flexible period of time by optimizing the binding/equilibrium constant—as particularly presented in the amended claims. Thus, for at least these reasons, the presently claimed invention would not be obvious in view of Drozd, alone or in combination with Rohrbach, as the features and methods of the presently claimed invention are neither disclosed nor suggested by either reference.

*Further Rejections in View of Graiff (US 5,300,218)*

The Examiner stated that Graiff discloses methods and devices for purification of fuels by passing fuel over adsorbents of the ion-exchange type, and further, teaches the use of cation and anion exchange materials (or acid/base materials). Applicants acknowledge that Graiff discloses the use of substances of the ion-exchange type to remove contaminants and discloses particular types of ion exchange resins presented in the presently claimed application. However, the presently amended claims provide for the strategic *release of a fuel additive* upon immersion of ion-exchange devices in a fuel—such devices and methods are neither disclosed nor suggested by Graiff.

Instead, Graiff discloses devices and methods requiring that fuel flow over the substrate for limited periods of time (less than 2 hours), to remove impurities but not to release desirable additives. (Col. 3, lines 1-6) Graiff specifically notes that the use of adsorbents, including ion-exchange resins, benefits the processing of hydrocarbons into a final fuel product. (Col. 3, lines 41-43) However, Graiff additionally provides that this method of adsorption is preferably used prior to supplying any additives to the fuel. (Col. 3, lines 46-47) In reviewing Graiff, one skilled in the art would likely perceive an anion-exchange resin as potentially helpful in removing contaminants, but undesirable in conjunction with supplemental additives (which may then be potentially adsorbed as well). Furthermore, Graiff teaches the use of the adsorbents and ion-exchange materials during the processing steps during fuel flow—and does not suggest a benefit to long-term immersion of such devices.

As previously stated, adsorption is a physical process and not a chemical reaction. The use of a permanently charged immersed resin that capitalizes on equilibrium directed ion exchange is not disclosed or suggested by any of the references. While Graiff acknowledges the benefit of these materials in removing impurities, one skilled in the art would not be inclined to combine ion-exchange resins with additives in view of Graiff. Further, the presently claimed invention achieves a specific release of additives by optimizing the binding/equilibrium constant of the resin holding the additive, prior to its long-term immersion in fuel.

As noted by the Examiner on Pages 4-5 of the Office Action (Jan. 17, 2006), Rohrbach does not teach chemical interaction between the filter elements and the additive to promote binding and displacement of the additive in the fuel. The presently amended claims provide for definitive components reciting the nature of the chemical interaction between the resin, additive, and fuel components that leads to additive binding and displacement—namely, the binding/equilibrium constant, which is a quantitative and qualitative characteristic.

In response to the Examiner's rejections of Claims 2, 4, 5, 7, 9, and 11-16, Applicants submit that as the device of Claim 1 (upon which these claims depend) is non-obvious—then consequently, the additional provisions of these claims would also be non-obvious.

Therein, in view of the present amendments and for at least the reasons presented above, it is respectfully submitted that the present invention would not have been obvious in view of the cited references.

It is respectfully submitted that the Examiner's rejections are hereby overcome and that the presently claimed application is now in condition for allowance. Thank you for your attention to this matter, and please contact me at your convenience if you have any questions or require additional information.

**FEES**

It is believed that there are no fees associated with this filing. However, in the event the calculations are incorrect, the Commissioner is hereby authorized to charge any deficiencies in fees or credit any overpayment associated with this communication to Deposit Account No. 05-1372.

Respectfully submitted,

 4-5-06

Dennis H. Rainear, Reg. No. 32,486

330 South Fourth Street  
Richmond, VA 23219  
Phone: (804) 788-5516  
FAX : (804) 788-5519  
Email: [Dennis.Rainear@NewMarket.com](mailto:Dennis.Rainear@NewMarket.com)